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ENQUIRY

INTO THE MEANS OF

PRESERVING and IMPROVING

T H E

PUBLICK ROADS

O F T H I S

K I N G D O M.

With OBSERVATIONS on the probable
Consequences of the present PLAN.

By HENRY HOMER, A. M. A
Rector of BIRDINGBURY in WARWICKSHIRE; and Chaplain
to the Right Honourable the Lord LEIGH,

O X F O R D,

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TO THE RIGHT HONOURABLE
THE EARL of AYLESFORD,
THE RIGHT HON. THE LORD LEIGH,
HIGH STEWARD OF THE UNIVERSITY OF OXFORD,
THE HON. WRIOTHESLY DIGBY, ESQ;
SIR WILLIAM WHELER, BARONET,
SIR THEOPHILUS BIDDULPH, BARONET,
WILLIAM BROMLEY, ESQUIRE,
MEMBER OF PARLIAMENT,
AND THE OTHER ACTING COMMISSIONERS
UPON THE TWO TURNPIKE ROADS,
ONE LEADING FROM DUNCHURCH IN THE COUNTY
OF WARWICK TO STONEBRIDGE,
THE OTHER FROM FINFORD, ALIAS RYTON BRIDGE,
IN THE SAME COUNTY TO BANBURY,
THE FOLLOWING ENQUIRY
FOUNDED CHIEFLY UPON THE EXPERIENCE, WHICH HAS
RESULTED FROM HIS CONNECTIONS WITH THEM,
IS WITH ALL HUMILITY DEDICATED,
AS A TESTIMONY OF HIS GREAT HONOUR AND
ESTEEM FOR THEM,
BY THEIR FELLOW COMMISSIONER,
AND MOST OBEDIENT SERVANT,

THE AUTHOR.

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ONE LEADING FROM BURCHURCH IN THE COUNTY
OF WARWICK TO STONERIDGE
THE OTHER FROM THROCKMOLLY ALIAS RYTON BRIDGE
IN THE SAME COUNTY TO RAMORE
THE FOLLOWING ENQUIRY
FOUNDED ENTIRELY UPON THE EXPERIENCE WHICH HAS
RESULTED FROM HIS CONNECTIONS WITH THEM
IS : IN ALL HUMILITY DEDICATED
AS A TESTIMONY OF HIS GREAT RESPECT AND
ESTEEM FOR THEM
BY THEIR BELLOWS COMMISSIONERS
AND MOST OBEYANT SERVANTS
THE AUTHOR

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ENQUIRY, &c.

CHAP. I.

Of the Utility of Publick Roads.

THE Preservation and Improvement of publick Roads have always been Objects of the internal Police of civilized States. Besides the Benefits, which result from them of Comfort to ourselves, and of convenient Passage to our Beasts and Carriages, they have a natural Tendency to keep up social Intercourse, to expedite Business, and to enlarge the Commerce of Mankind. By them Access is gained not only to the Necessaries and Conveniencies, but to the Elegancies and Refinements of Life. Particular Places become possessed of the Product and Riches of remote Countries. The same Advantages

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are derived from these inland Communications in a subordinate Degree, as arise from that more extensive one, which is opened by the watery Element to the most distant Regions; and by both together Mankind are united into one grand Commonwealth, each Part contributing its Share to the Subsistence and Enjoyment of every other.

Perhaps it would be no Exaggeration to assert that Schemes of this Kind have been more or less attended to, in Proportion to the Degree of publick Spirit, which has prevailed in every Age and Country. Certain it is, that Magnanimity and exalted Ideas of Liberty never blazed out with more transcendent Lustre among the *Romans* than at those Periods when the first of their publick Ways were constructed. It would almost surpass Belief, if the Fact were not supported by the Testimony of very credible Historians, that the celebrated Way from *Rome* to *Capua* over the *Campania*, above an hundred and twenty Miles in length, eight and twenty of which it was carried over a Morass called the *Palus Pomptina*, and the first Conveyance of distant Water into the City for the Supply thereof, brought by
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Means of a Canal, eleven Miles long, and chiefly cut through subterraneous Passages, were both carried into Execution in the patriotick Administration of *Appius Claudius Cæcus*, who supported the Office of Censor singly for that Turn.

And though Constructions of this Kind in modern Times have been neither calculated for such Duration, nor conducted with such Expedition, as those were, yet it is probable that there is no one Circumstance, which will contribute to characterise the present Age to Posterity so much as the Improvements, which have been made in our publick Roads. We need not carry our Enquiries into the State of *England* more than half a Century backward, before we shall be able to trace the dull Marches of our Ancestors through Mire and Clay, not only in their Visits to each other through the Cross Roads of the Country, but in those of the most publick Resort, and even in their Approaches to the very Capital. Journeys in Carriages from the remote Parts of *England* to *London* were considered as great Undertakings, and performed by short Stages only in each Day. Terror and Fatigue were

the constant Concomitants of these slow and dangerous Progressions; and the Fears and Anxieties of Friends, who were left behind in the Country, were never calmed, till they had certain Intelligence that the Travellers were safe arrived at their Journey's End.

The Trade of the Kingdom languished under these Impediments. Few People cared to encounter the Difficulties, which attended the Conveyance of Goods from the Places where they were manufactured, to the Markets, where they were to be disposed of. And those, who undertook this Business, were only enabled to carry it on in the Wintry Season on Horseback, or, if in Carriages, by winding Deviations from the regular Tracks, which the open Country afforded them an Opportunity of making. Thus the very same Cause, which was injurious to Trade, laid waste also a considerable Part of our Lands. The natural Produce of the Country was with Difficulty circulated to supply the Necessities of those Counties and trading Towns, which wanted, and to dispose of the Superfluity of others, which abounded. Except in a few Summer-Months, it was an almost impracticable Attempt to carry very considerable Quantities

tities of it to remote Places. Hence the Consumption of the Growth of Grain as well as of the inexhaustible Stores of Fuel, which Nature has lavished upon particular Parts of our Island was limited to the Neighbourhood of those Places, which produced them; and made them, comparatively speaking, of little Value to what they would have been, had the Participation of them been more enlarged.

To the Operation of the same Cause must also be attributed, in great Measure, the slow Progress which was formerly made in the Improvement of Agriculture. Discouraged by the Expence of procuring Manure, and the uncertain Returns, which arose from such confined Markets, the Farmer wanted both Spirit and Ability to exert himself in the Cultivation of his Lands. On this Account Undertakings in Husbandry were then generally small, calculated rather to be a Means of Subsistence to particular Families, than a Source of Wealth to the Publick. Almost every Estate was incumbered with a great Quantity of Buildings, to adapt them to the Convenience of the Occupiers. The clear Emolument resulting from them both to the Proprietors and Tenants was far
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more inconsiderable than what has accrued from the more extended Plan, upon which that Branch of Business is now conducted.

The great Obstruction to the Reformation, which has been accomplished, was founded upon a Principle adopted by Gentlemen of Property in the Country, which Experience has since proved to be as erroneous as it was selfish; *viz.* that it would be injurious to their Tenants to render the Markets in their Neighbourhood more accessible to distant Farmers, and consequently a Diminution of their own Estates. It ought for ever to be recorded to the Honour of the present Century, that it was the first, which produced publick Spirit enough to renounce that Prejudice, and by this Circumstance only to have given as it were a new Birth to the Genius of this Island. It is owing to the Alteration, which has taken Place in consequence thereof, that we are now released from treading the cautious Steps of our Forefathers, and that even our Carriages travel with almost winged Expedition between every Town of Consequence in the Kingdom and the Metropolis. By this, as well as the yet more valuable Project of increasing inland Navigation,

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a Facility of Communication is soon likely to be established from every Part of the Island to the Sea, and from the several Places in it to each other. Trade is no longer fettered by the Embarrassments, which unavoidably attended our former Situation. Dispatch, which is the very Life and Soul of Business, becomes daily more attainable by the free Circulation opening in every Channel, which is adapted to it. Merchandise and Manufactures find a ready Conveyance to the Markets. The natural Blessings of the Island are shared by the Inhabitants with a more equal Hand. The Constitution itself acquires Firmness by the Stability and Increase both of Trade and Wealth, which are the Nerves and Sinews of it.

In consequence of all this, the Demand for the Produce of the Lands is increased; the Lands themselves advance proportionably both in their annual Value, and in the Number of Years-purchase for which they are sold, according to such Value. Nor does there appear to have arisen even any local Injury to particular Estates by this Change of Circumstances; though, if there did, they ought to submit to it from the greater Advantage resulting to the Publick;

Publick; but they are yet more valuable as their Situation is nearer to the trading Towns, and as the Number of Inhabitants in such Towns is enlarged by the Increase of Trade.

There never was a more astonishing Revolution accomplished in the internal System of any Country, than has been within the Compass of a few Years in that of *England*. The Carriage of Grain, Coals, Merchandize, &c. is in general conducted with little more than half the Number of Horses with which it formerly was. Journies of Business are performed with more than double Expedition. Improvements in Agriculture keep pace with those of Trade. Every Thing wears the Face of Dispatch; every Article of our Produce becomes more valuable; and the Hinge upon which all these Movements turn, is the Reformation which has been made in our publick Roads.

The Design of this Treatise is to consider the most effectual Means of perfecting and perpetuating a Plan, which has been adopted with such real Utility both to the landed and commercial Interests of this Kingdom. It will doubtless appear a presumptuous Attempt in
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any private Person to undertake to throw new lights upon a Subject, which has already engaged so much Time of our Legislature, and been so often descanted upon by Writers, that any farther Remarks upon it must now seem unnecessary. Yet Experience shews how difficult it is to contrive general Rules, so as to fit all particular Cases; nor will the Reasonings, built upon Philosophical Theories, for want of due Attention to collateral Circumstances, be always found to correspond in Practice to what they appear to promise in Speculation. An Attendance on this Kind of Business, both as an Overseer of private, and a Commissioner for the Repair of Turnpike Roads, has led the Author to a more minute Consideration of the Subject, than would perhaps otherwise have occurred to him. His Observations he hopes will appear to be either founded in Facts, or otherwise to be such direct Inferences from Reason, as cannot be controverted. The very Nature of his Publication must stand clear from all Suspicion of any other Motive to it than publick Good; and therefore he doubts not but an Enquiry of this Kind, conducted

with Freedom and Decency, though it should chance to differ in particular Instances from the prevailing Opinions of these Matters; will be received with Candour.

C H A P. II.

Of the ancient Institution of Roads in this Kingdom, with a Sketch of the modern Parliamentary Provisions made for the Support of them.

AT the Time of the Accession of the Romans the Inhabitants of our Island are represented to have been very barbarous, and uncivilized in their Manners. They had no settled Places of Abode, but chiefly inhabited in Woods, where having cut down Trees, and inclosed a Plot of Ground with them, they erected themselves temporary Huts and Conveniencies for their Cattle, which they called Towns or Cities during their Stay in them. They were split into divers Factions and States, which

which were so far from being cemented together by any common Interest that they were almost at perpetual Variance with each other; and scarce ever more than two or three could be brought to unite against a common Enemy. These were the natural Effects of the wild and uncultivated State of the Country, over-run with Woods, without any regular Government, without Towns and without Roads, having little or no Communication with other Parts of the World, or even with each other.

Whether these Circumstances contributed to facilitate or retard the Conquest of the Island, may be an Object of different Opinions; but there is no Doubt that the Event served as a providential Means of rescuing it from Obscurity, and of introducing it to that conspicuous Figure which it has since made in the Theatre of the World. The *Romans* by conquering *Britain*, in effect laid the Foundation of it's future Greatness. The Inhabitants, whose Security before consisted in Woodland Retirements, were by them gradually brought to dwell in Towns and Cities. What opened convenient Places of establishing them were the Roads, which the *Romans* first caused to be

made in several Parts, of which there are many Remains to this Day; and particularly the four great ones from Sea to Sea, known by the Names of *Watling-street*, *Ikenild-street*, *Ermin-street*, and the *Fosse*; the latter of which is supposed to have been so called from its being raised with Soil out of the Ditches made on both Sides of it.

These Roads were originally made with great Cost and Labour; and as the Romans were particularly careful to enforce the Preservation of them by Laws, it is highly probable that they were properly supported so long as they kept Possession of the Island. But after it was abandoned by them, they seem to have been totally neglected for several Centuries amidst the Storms and Tempests, which were perpetually gathering from civil Distractions and foreign Invasions; till a little before the Norman Invasion *Leofstan*, Abbot of *St. Albans*, caused the Woods from the Edge of *Chiltern* to *London* to be cut down, especially upon the King's Highway called *Watling-street*; also Bridges to be built, and the Ways to be levelled for the Convenience of Passengers; for as to the Laws of *St. Edward*, *De pace quatuor Cheminorum*,
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i. e. *viarum sub majori judicio*, they relate to the Privileges not the Repairs of them. They shew indeed that the four *Roman Ways* were in great Repute in his Time, and were not merely the principal but probably the only Roads, which were distinguished by the title of the King's Highways.

After the *Norman Invasion* took Place, the Policy of the Conqueror seems to have been as much as possible to prevent too great Inter-course between the Inhabitants, of which we have a celebrated Instance in the Institution of the *Curfew* or Eight o'Clock Bell, which was commanded to be rung in all Parishes as a Signal that they were then to extinguish their Lights and retire to their Beds. Under the Prevalence of such Maxims, and indeed also under the Violence of Faction, with which the Kingdom was for many Ages afterwards convulsed, it is no wonder that we find no Provision, either Royal or Parliamentary, for the Repair of Roads, till the Reign of *Philip and Mary*; when it was first enacted as a Step towards bringing this Matter under better Regulation, that the Highways of every Parish should be always under the Direction of two Persons,

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to be chosen annually at a publick Meeting, by the Title of Surveyors; and who were obliged to take the Office upon them under Penalty of a Fine. Before this Statute, every Parish was obliged, as they are since, to repair their Roads of common Right, unless where any private Person was bound by Prescription or Custom to do it; and in either Instance they were compellable by Course of Law; but how little Regard is usually paid to Business, which is under no particular Inspection, and when for want of it universal Decay ensues, which induces Parishes to connive at each other's Neglects; how feeble the Operation of such a System generally is, and how insufficient for the Purposes intended by it, common Experience very evidently evinces.

From the Time that the Care of Roads became an Object of Parliamentary Attention, several Statutes have been made, which it would be unnecessary to recite, as Recourse may very easily be had to them. The Tenor of them is to give Directions to Surveyors how to proceed in the Execution of their Office, and to establish proper Powers in them to enable them to do their Duty. For this Purpose they

they are to conduct themselves by certain Rules laid down for them. The Proportion of Labour and Carriage, to be required of every Householder, Labourer, and Landholder, towards the Repairs ; by what Means they are to provide themselves with Materials ; and the Method, which they are to take to reimburse their Expences, are pointed out. They are also empowered to remove Nuisances, to turn Water-courses, to open Channels for the draining of Roads, and can oblige those, who have Lands abutting on the Highways, to cut their Hedges, and to scour and keep open their Ditches.

As a further Means to enforce the Execution of the Laws, there are also several Powers vested in the acting Justices of the County, in their single Capacity, at their adjourned Sessions within their respective Divisions, and at their Quarter Sessions. Any one Justice may present a Way, which is foundrous, upon his own View. The Justices of the Division are required to hold a special Sessions once in four Months, to receive from Surveyors an Account of the State of the Roads within their District, and to give Directions for the Amendment thereof;

thereof; to examine, upon Oath, into the Application of Money raised for the Repairs, to punish the Neglects of Surveyors, and to levy Penalties upon Defaulters: And the Justices at their Quarter Sessions have Power to enlarge the Highways, so that the Breadth of the Ground taken in do not exceed twenty-four Feet; to make Assessments not exceeding Sixpence in the Pound upon every Inhabitant of a Parish usually rateable to the Poor, for the Repair of the Roads, where the Statute-Duty is found to be insufficient; to hear Complaints, to redress Grievances, and finally to settle all Disputes which may arise in relation to this Business. To render these Laws as effectual as is possible, the Justices themselves also neglecting to put them in Execution, are made liable to Penalties.

Besides the Provisions before mentioned, which are calculated for the Repair of the Roads, there are also others intended to guard them from being injured, either by the Draught of excessive Weights, or the Construction of Carriages. As a Check against the former it is provided that no travelling Carriages, unless for particular Purposes, which are specified in
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the Act shall be drawn with more than five Horses, under the Penalty of five [1 G. 1. c. 11.] Pounds; that the Driver or Drivers, and also the Surveyor wilfully suffering them to travel with more shall be subject to the like Penalty; and that Waggon^s travelling for Hire or not shall not be drawn ^{G. 1. c. 11. 14} ^{G. 2. c. xlii. f. 6.} with more than six Horses, or Carts with more than four, on forfeiture of all above that Number, with the Geers and Accoutrements to the Person who shall seize the same. To prevent the latter, it is also provided, that no Waggon travelling for Hire, except for particular Purposes, which are also mentioned in the Act, having the Wheels bound with Streaks, and the Tire of a less Breadth than two Inches and an Half when worn, or being set and fastened on with rose-headed Nails, shall be drawn with more than three Horses, between *September 29th* and *April 15th* yearly, on forfeiture of all the Horses more than that Number with the Furniture, to the Person seizing the same; and that any Person obstructing the Execution of these Acts, and endeavouring to prevent such Seizures, shall, upon Proof before one Justice, be committed to Gaol for three

Months without Bail or Mainprize, and forfeit ten Pounds.

This is the Substance of the general Laws relating to Highways, and they seem sufficiently calculated to answer the Purposes intended by them, if Overseers were qualified with a sufficient Degree of Judgment to execute them properly, and of Industry and Spirit to do it effectually.

But partly through want of both, the Effect of them has been in a Manner totally lost. Indeed there is one Circumstance in that Part of them relating to the Statute-Duty, which must always be an Obstruction to the Execution of any Laws, and that is, that they are not founded upon Principles of common Justice. Every Person ought to contribute to the Repair of Roads, in Proportion to the Use they make of, or the Convenience which they receive from them; but neither of these Considerations seem to have been sufficiently regarded in the Determinations of our Legislature on this Point. A Farmer, who occupies only ten Pounds a Year and keeps a Team, is liable to contribute the same Statute-Duty to the Repairs with one who rents ninety and nine; and

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in larger Quantities, nothing less than fifty Pounds a Year makes any Difference in the proportion of Duty.

The Inequality in that of Housholders is still more striking ; for there all of every Degree are upon the same footing. Formerly Persons if they were assessed to the Payment of any Subsidy to five Pounds in Goods or forty Shillings in Land were to send two able Men ; but even this equitable Part of the Law is set aside by the Alteration of the Forms of raising Supplies for the use of the Government ; so that now the meanest Labourer, who does not stride an Horse once in seven Years, nor derives any other kind of Advantage from the Roads than the Carriage of a Load or two of Fuel in an Year for the necessary Supply of his Family, is required to be at the same Expence as the wealthiest Tradesman or Gentleman, who keeps no Draught. Nor is there any Kind of Regard paid to the Number of Horses and Servants of the latter, nor to the Disproportion between the Consumption of Necessaries and Benefit from the Roads, which the one has more than the other. So long as the Laws stand upon this footing, it must be expected that Statute-

Duty will always go on heavily; and indeed it is greatly to be wondered that this Inequality has been so long overlooked, amidst the shining Display of Justice, which crowns all the other Acts of our Legislature.

Certainly a more regular Observance of the Laws might be expected to take Place, if the Care of Roads, instead of being left to Officers chosen out of the Inhabitants of each Parish, who generally want Leisure to devote much Time to the Business, and almost always Judgment to conduct it, were committed to the Direction of Persons qualified for the Trust; and whose sole Business at the proper Seasons should be to attend to it. And it would also contribute greatly to a chearful Compliance with them, if all the Expences of the Repairs, instead of being thrown upon those, who really want Ability to bear the Burden, and can upon no equitable Principles be saddled with it, were regulated either by the other Parish-Rates, or by the Horses and Carriages, which each Person keeps for travelling the Roads, and the Drift of Cattle and other Conveniencies, which they obtain from them.

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We need not greatly wonder to find that Parish-Duty so unequally distributed, and exerted under such improper Direction has been in general found to be insufficient for the Repair of the Roads, and that under such Circumstances Recourse has been had to some extraordinary Measures, which were necessary, for their Support. Whether the Method adopted of a voluntary Taxation by Tolls to be collected of Travellers was the most eligible, is a Question, which has perhaps never yet been thoroughly discussed. Had this Business after the *Roman* Example been made National, and the military Force employed in Times of Peace in carrying it into Execution, besides the Advantage, which would have accrued to the Publick from their Labour, it would have prevented a great many Articles of Expence which have arose from soliciting the Acts, erecting Toll-Houses, Salaries of Gate-Keepers and other necessary Officers, as well as a great many Frauds.—Or if instead of Turnpike Acts being obtained for particular Roads, they had only been established on a more extended Plan, and made general throughout Counties, this would have been both a Means of reducing the

the Expence, and also a Check against a Solicism in Practice, which we have run into by the usual Management of Road Bills. As Things are at present conducted, the Commissioners of particular Roads, in order to enhance their Revenues, generally take the Liberty of blocking up the principal Avenues of every other Road, which falls into or leads across their's; which renders it very difficult, perhaps impossible, (if it should be thought expedient to repair any of those Side or Cross Roads) to raise Money for that Purpose; because the Means of doing it are already invaded by the former Set of Commissioners; so that in Fact every Act, which passes for the Repair of a Road, with the usual extensive Powers to Commissioners to erect Gates, is an Act also to prevent any of the Roads leading into or across it, be they ever so bad, from receiving the same Remedy. And thus the Repair of the Roads in general is obstructed for the Sake of one or two in a County, who have no other Claim to this Monopoly of the Toll, but that the Solicitors of them had the good Fortune to apply first for their Act of Parliament.

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But to return from this Digression, The particular Roads, which have obtained this Parliamentary Aid for their Support, are hereby brought entirely under a new Track of Management, and are also regulated by a System of Laws peculiar to themselves: The Parish Surveyors are no longer intrusted with the Conduct of them; but they are committed to the Care of Persons chosen by the Commissioners for that Purpose; who by the respective Acts from which they derive their Appointments, are usually invested with larger Powers, both with respect to the Means of providing Materials, removing Nuisances, improving the Roads, and preventing Injury to them.

Besides the Provisions made to this Effect in the several Turnpike-Acts, the Legislature has also endeavoured to set a particular Guard over them by some general Laws, as an additional Security to them. The Limitation of the Number of Horses for travelling Waggon before-mentioned, being thought inadequate to the End, Commissioners were first empowered to erect Cranes or Engines to weigh Carriages with their Loading, and to take Twenty Shillings an Hundred for every Hundred weight above Sixty,

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to be levied as the other Tolls. The Propriety of this Measure was universally acknowledged, and the Benefit of it felt, wherever it was adopted; but the Roads in general throughout the Kingdom being then in an imperfect State, and the Effect of this salutary Scheme only partially experienced, from the Circumstance of Commissioners having a discretionary Power to erect such Engines or not, the Laws were yet judged to be defective, and some farther Expedient necessary. In this Situation of Things the Resolution was formed of making Experiment of the Effect of Carriages of an entire new Construction, having Wheels with Fellies of the Breadth of Nine Inches; it being apprehended that by the Increase of the Surface, which supported the Pressure of them, the Roads would be secured from wearing into Ruts, and the Carriages themselves serve as Rollers to level any Inequalities in them. Upon this Principle they were not only released from any Restraint as to the Number of Horses for their Draught, and the Weight of their Loading, but also encouraged by a temporary Exemption from all Manner of Tolls; and when the first Æra of these extraordinary Indulgencies expired, they were again

again favoured with the Draught of Eight Horses, an Exemption from being weighed, and the Payment of only half the usual Tolls. At the same Time narrow-wheel Carriages were proportionably discountenanced by a farther Reduction of the Number of Horses for their Draught, and an additional Payment of Toll to compensate for the Defects of the former; and all Exemptions and Compositions allowed under particular Circumstances in the several Turnpike Acts, were confined to Carriages with Broad Wheels. Notwithstanding which they are found to be so unadapted to the Purposes of Husbandry, the Number of Horses requisite for their Draught so great, and the beneficial Effects of them to the Roads so questionable, that neither the Encouragements on the one Hand, nor the Discouragements on the other, have been sufficient Inducements to bring them into general Use. The Legislature itself seems to be sensible that the Preservation obtained to the Roads by adopting them has not been answerable to the Indulgencies granted; and accordingly in the late Alteration, which took place, Commissioners are empowered to exact Twenty Shillings an Hundred for every Hundred Weight above six

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Tons from Waggon's of this Kind, and they are subjected to the Payment of the full Tolls required in the respective Acts. But at the same Time, from a Supposition that the Security wanted might be obtained by a further Increase of the Surface, upon which the Pressure of the Carriages acts, the Indulgences granted under the former Act are continued to such as, having one of the Axle-trees longer than the other, are so constructed, that the fore and hind Wheels of each Side shall roll a Surface of at least Sixteen Inches in Breadth.

The Author of this Enquiry will hereafter have an Opportunity of explaining his Sentiments of these Machines, when he comes to treat of the Causes of the Decay of Roads, and the Operation of Carriages thereon; which the natural Course of his Work will lead him to do, when he has first offered his Observations according to the Roman Stile, *de struendis et muniendis viis*; the Subjects of his next Chapters.

C H A P. III.

*Of the Method of constructing Roads or
bringing them to a proper Form.*

THE principal Scheme of the particular Turnpike Acts passed by the Legislature of England, besides the Powers vested by them in the Surveyors already mentioned, has been to create a Fund for the Repair of Roads by establishing Payments from Persons who receive the Benefit of the Improvements. The Method of applying this Fund is left solely to the Discretion of some neighbouring Gentlemen, who are usually appointed Commissioners for that Purpose, and to Surveyors acting under their Choice and Direction; whose Business it is to take care that the Sums levied are properly expended in the Support of the Roads, agreeable to the Trust reposed in them. The first Object which presents itself to the Consideration of Persons under this Appointment, is to reduce Roads into a proper Form, without which there will be an extraordinary and useless Consumption of Materials in repairing them. It happens that

the Surface of the Earth partly from its natural, and partly from its acquired Inequalities, is often too irregular in Shape to answer the desired Purpose; nor is the usual Track of Roads in all Cases the most eligible. Yet it is not in the Power of every Set of Commissioners to aim at Perfection in these Points. A strict Regard to the Nature of their Trust, the Revenue of their Gates, and to the Sums which they may be enabled to borrow, must be the Rule of every Person's Judgment, how far it may be beneficial or prudent to embark deeply in Operations, which, though confessedly convenient, are too expensive. The Reputation of a Road, upon which depends also the Credit of the Tolls, is the grand Object of Commissioners Attention; and can only be secured by obtaining a convenient Passage throughout the whole Extent of it, with which an expensive Improvement of particular Parts is in many Instances incompatible.

Wherever the Frequency of Resort affords a sufficient Revenue to purchase Land for that Purpose, and also makes it a publick Convenience, it is always desirable to bring Roads, as nearly as Circumstances will admit of it, to straight Lines; in which form they wear better,
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and are more pleasant as well as commodious for Use; and whenever Bends are necessary they are yet more easily supported in right-lined obtuse Angles than in Curves.

For the same Reasons regular Forms are much preferable to uneven Surfaces; and therefore Risings and Hollows should be reduced into level, or rather, if it can be so contrived, into inclined Planes. Steep Ascents are always, if possible, to be conquered; because the locking of Carriage Wheels in the Descent, and the Difficulty of Draught in the Ascent render the Support of such Roads very expensive, and the Use of them very inconvenient. Undertakings of this Kind are generally arduous; but yet they may be accomplished in almost any Instance, by sinking the Paths at the Summits, and raising them at the Bases, by which Means their progressive Line is brought to an easy Inclination. This should never exceed an Angle of between Four and Five Degrees with the Horizon, if the Expence of doing it be not too great, because beyond that the Inconveniencies before mentioned will be sure to take Place.

The transverse Section of a Road, (except in Wash-Ways, where the Water is to be confined
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to the Track) should always be the Segment of a Circle, in order to give a lateral Descent; and this may either be the Portion of a greater or less Circle, as there is more or less of the progressive Inclination, and the Nature of the Soil may require it; or otherwise it may be the Portion of a large Circle with Ditches on each Side. In general, where the progressive Line approaches nearest to a true Level, if other Circumstances are equal, the greatest Convexity or the deepest Ditches are required.

The Reasons which render both these Dispositions in the Form of Roads necessary, are founded chiefly in the Effects of Water upon them. This Element under proper Direction is an excellent Means of Preservation to them, as it may be made to carry off the lighter Particles of Earth or Mud, and will leave the Sand and Gravel, which are specifically heavier, in the wearing Tracks; where they serve as a Guard to the Substratum of Materials under them: but a Stagnation of it is almost always prejudicial, and particularly so in loamy or Clay-Soils; in which, if it cannot be discharged, the best compacted Materials, unless of extraordinary Thickness, must gradually sink under the
 Pressure

Pressure of heavy Weights upon them. The progressive Inclination, where it is easy, is particularly adapted to procure the Advantages and guard against the Injuries of Water; but where this cannot be obtained, the lateral Descent must serve for its Discharge; and in all Instances the Convexity of Roads increasing their Surfaces in Proportion to their Bases, must give larger Scope for the Operation both of Sun and Wind upon them, and occasion a greater Drain to the Extremities of their forming. Yet it is to be remembered, that where Roads can otherwise be sufficiently drained, without making too deep Ditches on each Side, which are to be avoided, the transverse forming can scarcely be the Segment of too large a Circle; and that in those where greater Convexity is required, the travelling Track should be in the *central* Part of the Segment (upon which alone the Carriages are exactly poised between the Wheels) except in very dry Seasons, when the Balance inclining to either Side will make very little Impression upon the forming.

It has been thought by some that the most expeditious and least expensive Method of reducing Roads into their proper Forms, is by
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the Use of the Plough ; which, by repeatedly directing the Earth towards the same Ridge, will gradually bring it into the Form, which Lands are usually laid in for getting Crops in open Fields. But with respect to the progressive Line this can answer no Purpose ; because it operates only laterally ; nor is it of such Consequence towards the transverse Disposition, as to balance against the Inconveniences, with which it is attended, of making the Ground light where it ought to be solid, and of accumulating Earth, where there must be a Necessity either of removing it again to make a Bed for the Materials, or of bringing a great deal more to compleat the Form, after the Materials are placed. Where the progressive State of a Road wants no Amendment, the transverse will for the most Part be properly accomplished by only laying the Materials upon the natural Surface of the Ground, and forming up to them with Earth brought from the Extremities. This will of Course bring them to a regular Convexity, by which their Centres will be elevated two or three Feet above their Extremities, according to the greater or less Quantity of Materials used in the Repair of them ; or in such Roads, where the Centres
want

want but little raising, the same Thing is effected by digging a Bed for the Materials, and disposing of the Soil so as to make the Form regular on each Side.

At the first Revival of the Care of Roads in *England*, which cannot be said to have taken Place effectually, till the Adoption of Turn-pikes, it happened, as in most other new Projects, that Want of Experience led the Conductors into many very expensive Errors, chiefly arising from their Inattention to the Circumstance of laying them in proper Form. The Art of taking Levels was, at first, above the Capacities of common Surveyors, whose contracted Ideas extended no farther than to the Surface of the Land, which was the Scene of their Operations. To them it would have appeared a chimerical Undertaking to have attempted to execute any Plan for reducing Ground to a regular Descent, where it was to be effected by raising Vallies and sinking Hills. But Custom has enlarged their Conceptions, and familiarised them to a Conviction both of the Practicability and Utility of such Schemes. And the Business of Surveyors is now so much better understood, that any Hints of this kind would

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perhaps

perhaps have been unnecessary, but that they conduce to the better Illustration of the Subject.

C H A P. IV.

Of the Application of Materials to the Repair of Roads.

IN Roads of any considerable Resort, it is usual to bring the whole Breadth into Form, where it does not exceed forty Feet, and to form to the Breadth of about forty Feet, where it does ; which according to the Method generally practised, leaves convenient Passage on each Side of the mended Path, supposed to be in the Middle or Centre of the forming. The Breadth of the mended Path must be regulated by the Circumstances of the Commissioners, the Plenty of Materials which the Country affords, and the Convenience of getting them. This is seldom extended beyond fourteen Feet, and oftener only to twelve, in Roads, which are distant from the Metropolis ; where there is not ordinarily such frequent Occasion to turn out, as to render

der a greater Breadth necessary, or even desirable, if that was properly made use of. For five Months at least of the twelve upon an Average the Side Passages, in such as lie in good Form, will be sufficiently drained or frozen to bear Carriages; and at those Seasons the Use of them, when worn smooth, is by far more eligible than the mended Path; the only Purpose of which is to guard against any hurtful Impressions at such Times, as the natural Ground rendered pliable by Moisture gives Way to the Force exerted on it; for want of which Precaution the treading of heavy Cattle, and the Draught of great Weights, (except in Tracts of Land, which have a good deal of Sand or Gravel in their Composition) will, in Proportion to the Use made of them, and the Badness of the Season reduce Roads to a State of gradual Decay, and at last make them foundrous and impassable.

There are two Ways of adapting Materials to this End; one by regular Constructions, as Pavements; the other by a more promiscuous Assortment of Rock-Stones, Pebbles, Flints, Sand, Gravel, or the like. Of the former Kind the most celebrated, which stand recorded in History,

History, are the *Roman Ways*; of which the
 * *Appian* already mentioned, and the *Flaminian*

* The following Account of the *Appian Way*, taken from an
Italian Author will perhaps not be unentertaining to the Reader.

Appius Cæcus made the Way as far as *Capua* one hundred and
 twenty-four Italian Miles; from whence it was continued on to
Brundusium, (by the Descendants of *Appius*, as this Author con-
 jectures, in the Times of the Republick) Its whole Length from
Rome to *Brundusium* was two hundred ninety-three Miles. The
 Width of the Road is twenty-five Feet, but not always exactly;
 being wider in some Places, as where it passed through the *Palus*
Pomptina, and in other Places, as where it passed through De-
 files or Cuts made in the Mountains, not so wide.

The Stones, of which it is formed, are oblong, not square,
 nor of any regular or determined Shape. They are made Cone-
 wise at Bottom, and are at least a Foot in Depth.

The Border Stones on each Side are in some Places a Foot,
 and in others two Feet high above the Pavement. Besides the Bor-
 der Stones, there were on each Side, at about every forty Feet
 distance, Blocks of Stone that stood up higher for Passengers to
 rest upon, or mount on Horseback; which Blocks did not stand op-
 posite to each other on the two Sides of the Road, but alternately,
 so that one was to be met with in going every twenty Feet. The
 Road was also adorned with terminal Statues of *Mercury*, *Apollo*,
Bacchus, *Diana*, *Ceres*, and *Hercules*, which were set more parti-
 cularly at Cross-Roads and Boundaries of States or Cities.

When *Appius* made his Road, he built *Appii Forum*, as a Place
 of trading and marketting for the neighbouring Cities and
 Countries. And from hence the Road ran through the *Palus*
Pomptina for fifteen Miles, till within three Miles of *Anxur* or
Terracina. (But the Road seems to have entered the *Palus* before
 you arrive at *Appii Forum*, which appears to have stood in it. For
Cisterna is thirteen Miles nearer *Rome*; and here began the Foss
 that was made for draining the *Palus Pomptina*, which was be-
 gun by *Augustus* and completed by *Nero*. This Foss ran along
 by the Side of the *Appian Way*. Perhaps in the Time of *Augustus*
 it was brought no nearer to *Rome* than *Appii Forum*, for there

Horace

have been most distinguished. The first of these is said to have been entirely covered with hewn Stones, most of them eighteen Inches in measure on each Side of their Surface, and a Foot in depth; of such Solidity and Firmness in their Texture, and so well cemented together, that it is now entire in several Places for many Miles together, although upwards of two thousand Years have elapsed since its first formation.

The only Things of this Kind, which we have in *England*, and which are in no degree comparable to those already mentioned, are some Horse-Causeways and a few Waggon

Horace seems to have taken Boat.) Francesco Maria Pratilli della Via Appia. Napoli 1745.

The same Author gives us the following Extract from a *Latin* Translation of *Procopius*, who was a Writer in the sixth Century, upon the same Subject.

“ Ab Urbe Româ ad Capuam pertinet (Via Appia) eâ latitudine, ut adversa inter se duo plaustra liberè commeant. Omnium maximè spectabilis est. Molares enim et naturâ præduri sunt lapides omnes, quos certè Appius e remotâ aliquâ lapicidinâ illic convexit, cum vicinus ager nullos ferat ejusmodi. Eos autem lævigatos in planum et angulatos aptè commisit, non inserto ære aliâve quapiam re. Adeo tamen firmâ compage hærent, ut spectantibus non arte coagmentati, sed naturâ conge-niti videantur. Et quamvis per tot secula frequentibus plaustris ac jumentis quibuscumque quotidianum iter præbuerint, tamen nec ab ordine vel minimum cessere, nec fractus quisquam est nec minutus, nec pristinum nitorem amisit. *Lib. 1. cap. 14.*

Tracts

Tracks in and about great Towns, and in some of the publick Roads, chiefly those of *Cheshire* and *Lancashire*. These are Pavements constructed with common Pebbles, which are generally of a very hard Substance, and if well bedded in Sand, rightly disposed, sufficiently rammed and well covered, will afford a stout Resistance to the Pressure of heavy Carriages and be very durable.

But was this kind of Road eligible, Pebbles are not to be procured in sufficient Quantities and of proper Size in many of the inland Parts of the Kingdom, without an Expence, which is not within reach of the ordinary Revenue of Turnpikes. Besides this there are many Objections to them, being neither calculated for the Ease of Man or Beast, nor for the Preservation of Carriages. *Minus est gravis Appia tardis*, is a sufficient Intimation that expeditious Motion of Carriages on the *Appian* Way was attended with uneasiness to the Travellers, and the Observation is applicable to every other Road of the same Construction.

Indeed it may hold for a general Rule in making of Roads, that the finer the Materials are, which are used for the Composition of them,

them, the more convenient they are for Passage, if no other Objections attend them; accordingly we find by Experience, that those, which are made of the best Kinds of our *English* Gravel unscreened, are preferable for Ease, Safety and Expedition to those which are made of coarser, though more solid Materials. Nay, as was before intimated, the natural Ground itself, when rendered sufficiently smooth and hardened by Drought, is better adapted for use in all Respects than any made Road whatsoever.

It seldom happens that Surveyors have any great Choice of Materials to use in constructing their Roads. They are obliged to take such as the Neighbourhood affords, because distant Carriage is for the most Part an insupportable Burden. In those, which are made with Gravel only, the chief Requisite is to lay it of sufficient thickness; and whatever the Materials are, the Ground should be well formed to the Sides of them, to prevent them giving way laterally, which will of course lessen their perpendicular Depth, as well as weaken their Structure. Where Rock Stones are used wholly for this Purpose, it is usual to place the stronger

Parts with a cursory Kind of Pitching on the outfides of the Beds, where the weight of Carriages is expected to operate most, and to leave the weaker in the Centre supposed to be the Track for Horses, and to give the whole a covering with the shattery Parts of the Rock, or the stronger broke into small Pieces, without which they are apt to lie rough and very inconvenient for travelling upon. But wherever both Kinds are to be had, Durableness and Convenience are best consulted by making the Foundation of Stone, and the Superstructure with Gravel, screened or unscreened, according to the Strength of it, and the Pressure it is expected to undergo. In Clays or Soils, which retain Moisture, it has a very good Effect to lay a Course of Sand or Gravel, where it can be procured, or otherwise of the soft Parts of sandy Stone, before the Stratum of strong Stones is placed, which prevents them working downwards so fast as they are otherwise apt to do, and yet enables them for a while to yield to the Pressure of heavy Weights. Pebbles are of excellent use in Roads, when properly applied; particularly those which are gathered from Clay-Lands or Gravelly Soils, which are generally

generally observed to be of a closer Texture, than those which are found upon or riddled from light Earth.) But their smooth Surface and natural Gravity occasion them to be soon lost, when they are used for a Foundation. Rock-stones from their angular Form being less apt to give Way to each other, and from their Flatness and Size less liable to descend, are better adapted to that Purpose; and Pebbles are more effectually placed either in a Stratum upon them, or otherwise as a Supply to the Tracks of the Wheels, when worn; for which Purposes if covered with Gravel, they exceed almost any Rock-stones in Duration. Many good Roads are made with Sand only, disposed in the same Manner as Gravel; and they have also this Convenience attending them, that they are generally better in the Winter Season, when saddened with Moisture, than in the Summer, when their Texture being loosened with Drought, Carriages move more heavily along them.

But whatever Methods are made use of for the Purpose of securing Roads from Decay, it generally turns out an irretrievable Error, to be too sparing in the Breadth of the mended Path, and very bad Oeconomy not to allow a sufficient

Thickness of Materials, in the first Construction of it. For the latter no general rule can be laid down, because it must be regulated by the combined Considerations of their Strength, the Form of the Ground, and the Nature of the Soil in which they are placed; but for the former it ought never to be less than twelve Feet in publick Roads, for otherwise they will be too narrow to admit of Coach Quarters upon them, and the Weight of Carriages will also operate too near their Out-sides; and that Space well fortified is far preferable to a greater, which is done imperfectly.

It happens unfortunately that those Countries are often worst supplied with Materials, which stand in greatest Need of them, and this renders the Expence as well as Difficulty of supporting different Roads, or different Parts of the same Road excessively unequal; the very same Quantity being to be procured at more than treble the Cost and Trouble in one Instance, which they are at in another, and when procured, not near so effectual. In Places so circumstanced, which are also burdened with a great deal of heavy Carriage, and especially when the Roads in their first making

making have been executed imperfectly (as these are very apt to be) Commissioners have found it necessary of late Years to double their efforts for the necessary support of them, and yet impracticable to keep them at all Seasons so clean and pleasant for travelling upon as formerly. — That this is in great Measure to be attributed to the Defect of the present System of Regulations, the Writer himself is clearly of opinion. But without endeavouring to anticipate the Reader's Judgment either by Assertions or Suppositions, he will next endeavour to investigate the Causes of the Decay of Roads, and the mechanical Effects of Carriages upon them, which he hopes will set this Matter in a true Light.

C H A P. V.

Of the Causes of the Decay of Turnpike Roads, with some Remarks upon the Defects of the Provisions made to prevent them.

IT need not much excite our Admiration to find that in Roads which have never been reduced into any regular Form, the Materials perhaps blended with earthy or heterogeneous Particles, and not laid together of sufficient Width or Thickness, nor disposed with any Skill or Contrivance, the very Traces of Pains so imperfectly taken are in bad Countries soon lost and swallowed up, as was almost universally the Case with Parish-Duty, till within these few Years past. But it might be expected that others, which are made without any of these Defects, should be of considerable Duration, if Experience did not shew that continual Pressure of heavy Weights, will without frequent Reparation quickly reduce even these to a State of Decay. This Effect must necessarily
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be produced in the ordinary Course of Things in proportion to the Force with which they are acted upon, and their Inability to make Resistance. The greater the Weights are, which press upon equal Quantities of Materials, or equal Parts of a Road, the more must such Materials be pulverized or forced downwards, supposing other Circumstances to be equal; and the natural Consequence of either is, that they are worn away, or so far lost as to be of little Use without new Recruits. The Duration indeed might be secured for a much longer Continuance, as was before intimated, by regular Pavements with large Pebbles; but as the Difficulty of such Undertakings could only be supported by National Expence, and these Pavements when executed, would be far from being adapted to Convenience, the other Plan is certainly more eligible, if proper Guards and Restraints could be contrived to prevent them from receiving unnecessary Injury.

It is plain that those, which have been hitherto established, have been very far from answering the desired Purpose; and their Defects seem to have arose principally from Want of due Attention to the Manner of constructing Roads;
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by which they have been left exposed to unnecessary wearing by being used at improper Seasons, and to Confusion and Loss of Materials at other Times by being used in an improper Manner.

The Parts of Roads, which are strengthened with Materials, may be considered as mechanical Structures, contrived for the Support of Weights in passing over them at such Seasons as the Weakness of the natural Ground must otherwise yield to the Force of them. They are not improperly compared to Suits of best Cloathing, and as such ought to be used with Discretion and Regard to the Ends, which they were intended to answer. If they are worn at all Times, and upon all Occasions, can it be expected to happen otherwise, than that they will soon be reduced to the Condition of the worst? Or if they are both worn promiscuously together, what must result from such a preposterous Connection, but Irregularity in the wearing, and that the best will be soiled and disgraced by the worst? In short is it not contrary to all Principles of Mechanism to lay as much Stress upon those Parts of Engines, which are weakest, as upon those which are strongest?

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and yet this is the absurd Manner in which our Roads have of late Years been treated; partly owing to the Establishment of Broad Wheels, but chiefly to the unrestrained Liberties, which, under the Notion of their rolling and levelling the Roads, have been granted to all Kinds of Carriages, of going upon the mended Paths, when they are not wanted; of leaving them, when they ought to be used; and at any Time of confounding the Use of the mended and unmended, or the different Parts of the mended; all which, exclusive of the Increase of Weights, have a natural Tendency to consume Materials, sap the Foundations, destroy the forming, and of course to produce Dirt and Mire, especially in Roads, which run over a flat clayey Country, and are much frequented with heavy Draughts.

First of all there is an unnecessary wearing of the Roads from want of some Regulation with regard to travelling on the stoned or gravelled Paths, which often in this respect absolutely suffer more in drought than in wet Weather; because the Ground being then rendered hard, and incapable of yielding, such Materials, as are confined under the Wheels of Carriages, are
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from the twofold Torture upon them of the Pressure above and the Resistance beneath, sure to be broke into smaller Pieces, and by Degrees pulverized. It is evident from reasonable Principles that this Effect must happen, as well as clear from Experience that it does. For an attentive Traveller cannot but have observed that even Roads, which have been new made or at least plentifully supplied with new Materials, and well mended in the Summer Season, are almost always, at the Commencement of the Autumn-rains, if they have been much frequented with heavy Draughts, found to have a great deal of Mire and Nastiness even in the mended Paths, till they have been well washed with heavy Rains, when they become cleaner, and remain so, till the same or other Causes produce a Repetition of the same Effects.

Another Source of Injury to the Roads over bad Countries is occasioned by their being used in an improper Manner, especially at those Seasons, when the Use of them becomes necessary. We find by Experience, that in such Roads the present Convenience generally tempts Carriages, those of the Broad Wheel Construction particularly, to continue in the Tracks, which they
have

accidentally taken in the dry Weather, till they are reduced by Necessity or great Inconvenience, to quit them; or otherwise are hired by Surveyors (as has been frequently the Case since the late Regulation about laying Materials twelve Feet from the Centre) to delineate the right ones. These, as it happens, have sometimes the Wheels of one Side of the Carriages upon the weaker and those of the other on the stronger Parts of the mended Path; and this occasions them to wear differently, and exposes the weaker to Trials which they are neither intended for, nor adapted to. At other Times the Wheels of one Side fall upon, and those of the other off the mended Paths, from which Circumstance the Outsides are in danger of being weakened by giving Way; if they do not give Way, they are worn down below the Surface of the Ground, which is formed up to them; and by Degrees become covered with Earth, so that the Boundaries of the mended Paths are no longer distinguishable. On the other hand the Wheels, which move along the natural Ground being continued in the same Direction, till it is worn into Ruts or Hollows, the Outsides of the mended Paths are not only

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left destitute of their lateral Support, but these Hollows are also Receptacles of Water, which sap their Foundations, and, if not timely taken Care of, will endanger the Demolition of their Structure. It is almost needless to add that where the Ground adjoining to the mended Paths is naturally dirty in wet Weather, this improper and unnecessary Intercourse between one and the other must, in the before mentioned Cases, of Consequence increase the Quantity of Dirt at certain Seasons in them, and in Proportion to the Breadth of the Wheels, to which it adheres.

Perhaps it may be alledged in answer to these Arguments that it is Part of the Business of Surveyors to apply Remedies to these accidental Evils, as they happen—that Roads, when they are dirty, may be washed clean by Water directed or pumped out of adjoining Pits upon them; that Water standing upon any Parts of a Road may be let off to the Outfides of the forming, and the Hollows filled up. In some Instances the Dirt may be certainly cleared away by washing, but not in all. Some Roads have not Descent enough to admit of this Remedy; others, which are capable of it from
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their Inclination, have not the Benefit of Water: Besides the Difficulty of doing this is enhanced by their different Parts being promiscuously worn, which occasions their whole Breadth to want washing, and requires a much larger Quantity of Water, than would be necessary to supply narrower Tracks, if the Wheels of Carriages were confined to such. With regard to the letting off Water and filling up Hollows, an attentive Surveyor may undoubtedly prevent a great deal of Injury by timely Application; but Ground, which is new made at the Commencement of Winter will hardly become solid for that Season; and while the Earth continues loose, it will lodge Moisture, be weak, and unable to afford any Support to the Outfides of the mended Paths.

The greater or less Tendency of Broad and Narrow Wheels to contribute to these Effects will be considered more particularly in another Chapter. At present it may suffice to observe, that Roads, which are circumstanced as before described, are not Proof against the before mentioned Treatment from either. The only Way of using these properly, is, by applying the Weights to these Parts, which are calculated

to receive them, and those are the Centres of the mended Paths; where they will be exactly poized between the Wheels of each Side of the Carriages; will not press upon the weaker Parts of the Roads, nor exert their Force too near their Outfides; where there is no unnatural Intercourse between the Paths, which are mended, and the adjoining Ground, which is not mended; where the Tracks will be worn equally, and when worn may be repaired with Materials chosen for that Purpose; of double the Strength to what the Generality are, and consequently capable of affording double the Resistance; and to all these Advantages it may be added, that the Dirt will be much more easily cleared away from them, and the Quantity of it be not near so great.

If the Nature and Reason of the Thing does not manifestly evince this to be a true state of the case, the Writer appeals to the judgment of any Persons, who, since the establishment of broad Wheels, have directed or executed the Repairs of Roads within the Counties of *Warwick* or *Northampton*. These, from their Neighbourhood to Collieries, the Product of which is wholly circulated by Land Carriage, and from their

their being the Channels for conveying the Goods of our greatest manufacturing Towns to the Metropolis are perhaps more burdened with heavy Draughts in proportion to their Revenues than any other Counties in the Kingdom, and are also very unhappily circumstanced in many Parts both with respect to natural Soil and Materials. Have not they been all along most easily supported, when Carriages have been confined to the proper Tracks? Has not the promiscuous use of different Parts, instead of answering any good Purposes of rolling and levelling the Surfaces, been the occasion of an extraordinary Increase of the Consumption of Materials, and of the Quantity of Dirt in them? Have not both these Effects been produced in a greater or less Degree in proportion to the licence taken by Drivers of going upon the mended Paths, when they are not necessary, and of using them improperly, when they are? And with submission to the Wisdom of our Legislature it may be also asked, Has not the Restraint laid upon Surveyors from enforcing this Plan by disposing Heaps of their Materials along the Outfides of the travelling Tracks been productive of apparent ill Consequences? If this Regulation

gulation was only intended to enable Carriages to turn off with greater Facility when they meet, might not that have been equally well provided for by ordering such Heaps not to be placed on the same Sides nearer to each other than sixty or seventy Feet asunder, which would have answered the Purpose of Security to the Roads, and have effectually removed the Inconvenience of obstructing Passage. Whereas now by making it penal in Surveyors not to remove them to the Distance of twelve Feet from the Centres within twenty four Hours after they are laid down, a Door is opened to all the Evils which can arise from the wanton Abuse, obstinate Perseverance, or careless indifference of Drivers, whose practice is seldom directed by any Attention to the means of preserving the Roads, or even by prudential Regards to their own Interest.

If nevertheless it should be insisted upon, that these are only partial Observations, respecting Roads under particular Circumstances, yet surely those which are supported with the greatest Difficulty and Expence, ought to be Objects of particular Attention. Where the Soil of the Country is naturally adapted to carry Burdens,
where

where the Revenues are large, arising for the most Part from light Carriage, and Materials are both plentiful and conveniently situated, (as is the Case with most of the Roads about the Metropolis) few Difficulties concur to render the Task of repairing them disagreeable, in comparison of what attend those, which are destitute of all these Advantages. Therefore if all Roads are to be regulated by one general System, the Barriers in Reason ought to be principally calculated for the Security of the weakest, and such, whose Strength, when impaired, is least easily recruited.

But perhaps the Inconveniencies complained of might be in a considerable Degree guarded against, by vesting in Commissioners a discretionary Power of framing By-Laws for the better Protection of the particular Roads within their respective Districts, and of enforcing a submission to them with moderate Penalties. Such a Power exerted only to controul any injurious Treatment with heavy Draughts, by directing the Times when they may go on the mended Paths, and when not (which cannot properly be ascertained by any general Provision, because it must depend upon Circumstances,

Circumstances, which are accidental) and describing the Tracks, which they are required to make use of (of which those, who attend to the Repairs, are certainly the best qualified to judge) might be productive of many great Advantages, and could be liable to no just Objection. At least Commissioners should be authorised to mark the Boundaries of the strengthened Parts, and heavy Carriages restrained by some general Law from confounding the use of them with the natural Ground under severe Penalties.

Perhaps the Author may be thought to stand in need of some Apology for not having treated this Part of his Subject in a more extensive View; but as the Causes of Decay, which arise from defect of Form, weakness or improper Application of Materials have been hinted at, and may be judged of from the preceding Chapters, the Design of this was to enter only into a Discussion of those Injuries, which are sustained from particular Modes of Usage, the Causes of which being removed the Effects must of Course cease. Injuries of the same Kind in an inferior Degree will ensue from the treading of large Drovers of heavy Cattle, which

which might also be lessened by confining them to proper Tracks ; but the Difficulty of doing this renders the Inconvenience arising from that necessary to be submitted to. The Case is very different with respect to Beasts employed in drawing, which being connected to the Object of their Draught, and taught to move as they are directed, the Drivers can regulate them by any System of Rules prescribed for the Conduct of them.

After all, no Provisions can be contrived to secure Roads from that wearing and decay which is the natural Result of the common Operation of Draughts upon them. The only Way to alleviate these must be by the Construction of the Carriages, or a Limitation of the Weights. With regard to the former it certainly appears consonant to Reason that the bearing Surface of Carriages being increased, the Weights also may be increased. And supposing that the Weights operated only in a perpendicular Direction downwards, and that the Surfaces of the Ground and of the Wheels were so level and corresponding to each other that every Part under the Wheels took its Share of bearing, the Increase of the Surface in any

I Proportion

Proportion greater than the Increase of the Weights must lessen the Pressure. But perhaps it will be found upon Enquiry, that other Circumstances ought to be taken into the Account; that this is not an exact State of the Case; that Facts do not always answer to this Theory, and consequently that the Reasonings established upon it have been partial and defective.

C H A P. VI.

Of Carriages, and their Operation upon Roads; with a View of the comparative Effects of Broad and Narrow Wheels.

CARRIAGES in mechanical Construction are compound Machines, moved forward by Means of a Combination of Levers under the Denomination of Spokes, connected together by their Insertion into the Hubs and Fellies, and acted upon successively in rotation, from their orbicular Position, and the Revolution of the Wheels about their Axes.

Horses

Horses are the Powers, by which these Machines are usually put in Motion; whose Bodies are confined to the Shafts or Poles, but their Strength operates upon the Spokes; and the Distance of the Power is as the Length of the Radii of the Wheels; so that if Carriages with large Wheels were in other Respects as well adapted to use as those with smaller, the larger the Wheels were the more easy would be the Draught; and the more easy the Draught, the less Impression upon the Road. But it is found by Experience that Horses can exert their Strength most effectually, when the Traces, by which they pull, are in an horizontal Line from the Axle of the Fore-Wheels, or a little inclined upwards. Nor will it answer the same Purpose to fix the Traces lower than the Axle-Trees, because in that Case, the Power being applied in a Direction below the Center of Motion of the Carriages, the Strength necessary to be exerted would be as much greater, as it would be if the Radii of the Wheels were less. Besides this Inconvenience, there is so much Difficulty of turning, and Hazard of over-turning, with large Wheels, that how specious soever they

they may appear in Theory, the Practice of them is universally rejected.

The Fulcra or fixed Points which regulate the Motion of the Carriages, are the Axles of the Wheels, which are also the immediate Supporters of the Weights; but from them they are communicated to the Plane of the Road by Means of the several Spokes and Fellies, as they succeed each other in their Descent to it. So that the Pressure of the Weights falls ultimately upon the Earth; the subjacent Parts of which successively become Fulcra to these progressive Leavers, and receive Impressions as other mechanical Instruments, according to the Strength of the Materials which compose them, and the Degree of Force with which they are acted upon.

The Action of Carriages upon Roads must be considered as twofold; one, the Pressure of the Weights, the other the Friction between them and the Earth. In those of the same Construction and Loading, the Pressure of the Weights taken collectively is always precisely the same; but the Friction depends upon the greater or less Resistance which they meet with
in

in passing over any given Length of Road, so that it is proportionably lessened or augmented by those Circumstances, which facilitate or retard their Motion. The straighter the Line of Direction is, in which the Power acts; or if the Distance of the Power be increased, or an additional Force be applied to it; or if the Carriages move along an even and hard Surface, or downwards upon an inclined Plane, where they are impelled forward by their own natural Gravity, the Motion in all these Cases being accelerated, or rendered more easy, the Friction is less. On the other Hand, when the Reverse of any of these Effects takes Place, the Resistance or Difficulty of Draught being increased, the Friction is more. By this Standard we may form a Judgment of the wearing, which arises from the Action of Carriages upon Roads, whose Construction and Loading are the same. But in those which are differently circumstanced in respect to the Quantity of Weights, and the Breadth of their Wheels, it must be ascertained by an Attention to several other Particulars, as well as these.

Did the Centres of Gravity in Carriages coincide with their Centres of Magnitude in every Position

Position of them, each Wheel would take an equal Share of the Weight; but this happens only upon exact Levels, and when the Loading is equally ranged over the Beds of them. Under other Circumstances it is perpetually fluctuating, and falls more or less upon the fore or hind Wheels, according to the Degree of Progressive, or upon the side Wheels, according to the Degree of lateral Inclination, or otherwise according to the Disposition of the Loading.

If likewise the Weights of Carriages operated in a perpendicular Direction only, the Effects arising from them must be in Proportion to the Quantity and Strength of the Substratum, which sustained them; but there are many Cases, wherein they have also some Degree of lateral Action; and indeed the Wheels of Carriages are always constructed with an Inclination of the Spokes a little outward from the Hubs, by which they are thrown more upon the Perpendicular in Case of any Inclination to either Side; and consequently are more capable of supporting the increase of Weight, which falls upon them by that Situation. But this occasions the common Pressure of Carriages, when they

they are poized between the Wheels on both Sides, not to be in a Direction exactly perpendicular to the Axles, but a little tending outward, or in a Ratio compounded of the perpendicular, and the lateral Distance of the Spokes at their greatest outward Inclination from it.

Again, were the Surfaces of the Wheels and Ground which they move upon so exactly even and corresponding in all Instances to each other, that every Part of the Substratum took an equal Share of the bearing, the Pressure of the Weights would always be in a reciprocal Proportion to the breadth of the Wheels; that is proportionably less, when the Wheels were broader, and greater when they were narrower. But under any Variation of the aforementioned Circumstances the Effect will be different; for if the Tire be not extended over the whole breadth of the Fellies, or if there be any Inequalities on the Tire, by means of rose-headed or other Nails, with which it is fastened, the Prominences on the Wheels must first make an Impression equal to their Depth, before the other Parts can be brought to bear upon the Ground. On the other Hand when the Ground,

upon

upon which Carriages move, is uneven, which will always be the Case in some Degree upon Roads, which are supported with any other than fine Materials, and especially after they are new made or mended, the whole breadth of the Wheels will not bear upon it, till they are worn smooth and consolidated together, and of Consequence, that which receives the bearing must support the Weights. From a due Consideration of these Premises we shall be able to infer the Effects of Weights upon Roads under all Circumstances of the Position and Construction of Carriages.

Whenever they press perpendicularly, it is in Proportion to the bearing of the Wheels; but as far as they act laterally, it is in Proportion to the Weights.

The lateral Effect of Carriages is inconsiderable, where they keep moving forward in a straight Line and upon even Ground, and in the middle of the mended Paths; but the more they deviate from that Direction, and especially in turning out of Ruts; and the nearer they approach to the Outfides of the mended Paths, and especially if the adjoining Ground be worn into a rut or be otherwise weak and incoherent, it becomes proportionably greater. By

By the lateral Action of Carriages Materials indeed are not so much worn as displaced; but by their being displaced the Parts are weakened from whence they are removed, and the Materials are often buried or thrown loose into the Tracks, in which Situation they are pressed upon by the whole Weight of the Wheels passing over them.

The perpendicular Pressure of Carriages being in a reciprocal Proportion to the Bearing and Weights, it must be increased by whatever Circumstances diminish the bearing; and since Effects are always proportionable to their Causes, an Increase of the Weights under equal or less Bearing must of Course produce proportionably greater Effects.

If a certain Degree of Pressure, as for Instance that of two Tons, be necessary to destroy the Contiguity of Parts of any one Piece of Material, or System of Materials connected together by a Bearing upon each other, half that Weight may repeatedly pass over such Materials without producing any sensible Effect; although by the addition of the other Half they will be immediately broken to Pieces with a single Impulse.

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By the lateral and progressive Inclination of Carriages, the Weights may be increased upon particular Wheels to near double what they are when they stand upon Levels, and consequently proportionably greater Effects must be produced by such Increase.

From this Detail it is evident that the Destruction of Materials upon Roads depends much more upon the Increase of Weights than has been generally imagined; and that the Increase of the breadth of the Wheels, though in a greater Proportion than that of the Weights, is by no means a Compensation for it; because the whole breadth in many Instances, from the Inequality of the Ground or Wheels, will not be brought to bear; whenever it can, the first Impression must be made by the Nails where they are prominent, perhaps by a single Nail; or the Bearing may happen upon single Pieces of Materials, or upon the Edges of Materials incapable of supporting the Weights; and besides, though the Loading taken together be little more than doubled under an almost four-fold Increase of the breadth of Wheels, yet under certain Positions of the Carriages, the Weights may be increased upon particular
Wheels

Wheels so as to be in greater Proportion than the Increase of the Breadth in ordinary Situations; and to these Disadvantages arising from Increase of Weights it may be added that all Kinds of loose Materials are more confined under broad than narrow Wheels; from the Pressure of which, the smooth Surface of Pebbles especially, easily sliding over each other while unconnected, might often facilitate their Escape, which it is impossible for them to effect from under broad ones.

The proportionable Effects of Friction are much more difficult to be ascertained than those of Pressure, not only because of the Variety and different Strength of the Materials, which Carriages pass over, but even in those of the same Nature and Construction. Where other Circumstances are equal, it depends upon the Weights of the incumbent Bodies, and the Quantity of the Surfaces which are opposed to each other; and if the Weights are increased in Proportion to the Surfaces, the Friction will undoubtedly be increased in the same Proportion also. But mechanical Writers have found it difficult to determine the Proportion of it, where there is an Increase of Surface without

an Increase of Weight, or where there is an Increase of Weight in any less Proportion than that of Surface. In general only it is computed that *ceteris paribus* it increases with the Weight, and that it is made greater by an Increase of Surface under the same Weight and Velocity, where the Substratum is strong enough not to give way to the Pressure.*

From this Method of estimating it appears, that the Friction of broad-wheeled Carriages against made Roads is greater than that of narrow-wheeled ones, even where the Weights are the same; and consequently where they are double, it must be proportionably increased.

The same Inference will also follow in regard to Friction as did before in regard to Weights, which is, that in all Cases, where the Bearing happens on particular Parts of the Breadth only, or where by accidental Situations the Weight is thrown more upon particular Wheels, it may be increased to be as great or greater in Proportion to the Surface than it is in narrow-wheeled Carriages in the ordinary Course of Usage; and in Ascents it is probable that, ex-

* See *Emerson's* *Mechanicks*. 2d edit. pag. 172.

clusive of Weights, it would be found upon Examination to increase more by Surface than on Levels.

These Principles will necessarily lead us to conclude that an increase of Weights, though supported by more than a proportionable Increase of Surface, must produce an extraordinary Consumption of Materials, especially of such as are coarse, when used in the Repair of Roads; and though the Variation will be different according to the Nature of the Country, and the Treatment they undergo, yet in all bad Soils it would probably be found upon Enquiry to have been so great, since the Encouragement given to broad Wheels, as to be sufficiently alarming. At least the Writer can truly affirm that in those Parts of his own Neighbourhood, which fall more immediately under his Observation, and are much frequented with these ponderous Machines, it is now almost double to what it was before that Event, though the Roads in general are in a less eligible State; and supposing that the same Track of Management was to prevail for a Course of Years to come, it is difficult to conceive, where Resources of Materials will be found in future Ages

Ages sufficient to keep the Carriages of Posterity above Ground.

And now we shall be able to give some Account of the comparative Effects of broad and narrow-wheeled Carriages, and the Reasons upon which the Exchange of the latter for the former was founded. At the Time of passing the first Act for the Establishment of broad Wheels, the Roads were in general, as has been before intimated, in an imperfect State. Several Turnpikes were then in their Infancy ; the forming and stoning of particular Parts was not compleated. In many, where it was, the Business had been done with so little Discretion and Judgment, that it was necessary to alter and re-execute it upon another Plan. The Management of Roads was neither so well understood, nor so carefully attended to, as Necessity and Experience have occasioned them to be since. In these Circumstances it is no wonder that many Inconveniencies followed from excessive Weights upon narrow-wheeled Carriages for want of sufficient Restraint. The only effectual Provisions, which were made to prevent them, were a limitation of the Number of Horses for Draught to five, and a discretionary

discretionary Power vested in Commissioners to erect Cranes for weighing them; which Method was too expensive upon Roads, whose Revenues were small; and attended often with too much Trouble and Delay in those of great Resort. Otherwise they were well calculated to have answered the Purpose, and to have produced the desired Effect. To obviate these Difficulties, a new Method of constructing the Carriages was thought proper to be encouraged, by which the Expence of erecting Cranes would be avoided to Commissioners, and of Trouble and Delay to the Draughts. From these it was expected likewise that the Inequalities upon Roads would be made level, and yet the Impression of them be less, as they acted upon a broader Surface. But it is found by Experience that in bad Countries these Carriages, as they are occasionally obliged to leave the mended Paths, bring more Dirt into them at their Return by means of their breadth; that in many Circumstances they act with more than double Violence upon the Materials, and reduce many of them with one or two Impulses to Powder, which would stand the repeated Shock of inferior Weights; that when converted

verted into that State they mix with the natural Dirt and increase the Quantity of it; that the Roads at particular Times are by these means rendered very disagreeable to Travellers, and hurtful to the Cattle employed in Draughts; that the shifting of Tracks, which they were intended, and from their Construction, are better enabled, to do, is productive of an Usage very injurious to Roads, which are only fortified to a certain Breadth; that although their wearing is indeed confined more to the Surface, and does not ordinarily operate to that Depth, which heavy Draughts constituted with narrow Wheels do, yet upon the whole it is greater and more destructive of Materials; that of Consequence the Expence of supporting Roads since their Establishment has been greatly enhanced; nor has that of Carriage been at all lessened, notwithstanding the Resources of Posterity have been anticipated for them, and they have been favoured first with a total Exemption from, and afterwards a considerable Mitigation of, the Payment of Toll to which other Carriages have been subjected. And whether they have then been productive of any equivalent Advantages, or whether the Inconveniencies arising

arising from Narrow Wheels under proper Regulations can be set in competition with these, the Writer thinks there will be no Difficulty to determine.

There never was any Thing more wanted to prevent the Injuries arising from Narrow Wheels, where Roads were tolerably well made and under good Direction, but a Limitation of their Weights, and to confine them to proper Tracks. As the Difficulty of accomplishing the former was the chief Object of Inducement to alter the Construction, the End might have been effectually obtained, by directing the Carriages to be made lighter, which would have made it necessary for the Owners to have saddled them with less Burdens. But the Method which was adopted of Increase of Surface, was no counter Ballance to the unlimited Increase of Weights; nor probably would it be even in those of the new Construction, if they were to come into general Use. Certainly it would not, unless some Provisions were made to prevent them from unnecessarily using the mended Paths in Summer, and to confine them as much as possible in Winter to them.

This is the Point, upon which, next to the
L Weights,

Weights, the proper Management of Roads with either Kind of Draughts seems to turn. Without some Restraint Carriages must always be expected to travel with the greatest Loading in Summer; and if the Side Passages were strong enough to support them, and were only made use of, no great Injury would result from it. But if they come upon the mended Paths, both the Pressure and Friction will be more powerful at that Season to destroy the Texture of Materials than in Winter. On the other hand Experience always shewed, that the License of cutting and using different Tracks in Winter with heavy Draughts not only rendered the travelling incommodious for light Carriages, to which this Indulgence should be confined, but was in the End destructive of the Roads, and prejudicial to themselves. With regard to those with Narrow Wheels in particular, if they were under proper Subjection in these respects, the Ruts or Trenches, which they would make, might, in Roads of any considerable Degree of Strength, easily be supplied with stout Materials, sufficient to prevent any Inconvenience from their Depth; and this only being guarded against, they would be so far from

from being prejudicial, that they would serve as Channels to carry off the Dirt and Moisture from them, and of course to contribute to their Cleanness and Preservation.

Perhaps the Author may be thought to wander a little out of his Way in mentioning, what is an indisputable Fact, how little soever it may have been attended to ; namely, that nothing could have had a greater natural Tendency to establish Monopolies in the Articles of Agriculture and Carriage, than the Encouragement which has been given to Broad Wheels, or, in other Words, to heavy Draughts. For as this cannot be accomplished without great Strength of Horses, it must necessarily throw the Business of Carriage into fewer Hands ; into the Hands of the wealthiest and greatest Farmers, the Extent of whose Farms will enable them to keep, and whose Produce is considerable enough to make it answer a very beneficial Purpose to them to adopt them. On the other hand, the Increase of Tolls to which Narrow Wheels are subjected, and the Reduction of their Number of Horses, amounting almost to a total Prohibition of the Use of them upon Turnpike Roads, must proportionably distress

the Occupiers of small Tracts of Land, whom Necessity compels to do their Business with such Draughts and no other. As long therefore as this Measure is persisted in, it must be expected to weaken the Hands of the latter, and strengthen those of the former; that the Consequence of that must be, that the Number of the latter will gradually decrease; that the unequal Terms, upon which the Residue convey their Grain to Market, will in many Instances induce them to dispose of it at home; that this Practice will lead to a Forestalment and Jobbing of Grain by those, who have the Wealth; and that thus by a natural Train of Events, the whole Trade of the Markets will be, in a Manner, played into the Hands of those, in whose Favour the Ballance of Profit is already so evidently inclined.

C H A P. VII.

Of Inland Navigation.

THE continual Tendency of Roads to Decay, notwithstanding the immense Sums, which have been expended in their Repair ; the Difficulty of obtaining Materials in many Places, and the great Quantities consumed in all, have made it an Object of National Concern to devise some Scheme either to lessen the Consumption, in order to prevent the pernicious Consequences of our Stores being exhausted, or to substitute some other Plan of Conveyance for the heavy Goods, with which the Roads are oppressed.

Nothing could have been better calculated to extricate us from these Inconveniencies, than the Spirit, which at present prevails among us, of increasing *Inland Navigation*: which is performed by the Medium of an Element brought to us without any Expence of Carriage, being showered down from Heaven in the ordinary Course of Nature ; the Sources of which will never fail, as long as the World subsists ;
and

and the Materials, though fluid and yielding to the least Impulse, are yet adapted to the Support of the greatest Weights, nor are capable of being lessened or destroyed by wearing.

The first Expence of making these watry Paths being defrayed, what is afterward incurred for their Support is inconsiderable, from whence it is reasonable to conclude, that in the long Run they will be cheaper for heavy Carriage than Roads * ; the original Construction

* Left the Expences of Roads should be thought to have been here exaggerated, the following Account is inserted of Materials used for the ordinary Repair of a District somewhat less than five Miles long in a Part of *Warwickshire*, upon the great Road leading from *London* to *Chester*, in the Course of three Years last past.

		Tons.	Tons.
In 1764	{ Limestone — — —	558	In all 3702
	{ Picked Pebbles — — —	916	
	{ Screened Pebbles or Gravel —	2228	
In 1765	{ Limestone — — —	841	In all 3819
	{ Picked Pebbles — — —	738	
	{ Screened Pebbles or Gravel —	2231	
In 1766	{ Limestone — — —	700	In all 3961
	{ Picked Pebbles — — —	916	
	{ Screened Pebbles or Gravel —	2345	

which is about 750 Tons a Year for each Mile, each of which upon an Average within that District costs 1s. 10d. all Expences included, when delivered into the Road, making in the whole for Materials only, 681. 15s. 0d. Other Attendance is usually computed at a Man for a Mile, which at 12 d. a Day is 15l. 12s. 0d. a Year, so that the total Expence of the annual Repairs of a Mile within that particular Tract is 841. 7s. 0d.

But

of which in many Instances, costs from two to seven or eight hundred Pounds a Mile, and their annual Repairs little less, sometimes more, than one.

But besides that Water Carriage bids fair for Preference to that of Land, considered with a View to publick Oeconomy, there are many other Objects of National Advantage resulting from it. The Preservation of the Roads must be a necessary and immediate Consequence of their being relieved from the Pressure of heavy Burdens. The Manufactures of the Country

But there are other Parts of the same Road, where at least an equal Quantity of Materials is wanted, and the Expence of them is not less than 2 s. 10 d. a Ton when delivered, for those of the same Strength, which according to the before-mentioned Method of Calculation is, for Materials 106 l. 5 s. 0 d. Attendance of a Labourer 15 l. 12 s. 0 d. in all 121 l. 17 s. 0 d. a Year for each Mile.

It is worth Notice that from the above Account the Consumption of Materials appears to have increased in the succeeding Years beyond what it was in the former ones, without any such Improvement to the Road, as might have justified the Application of a less Quantity. The Expence of Carriage must also be a gradually increasing Article; because, when all the Lands adjoining to a Road have been searched for Materials, Recourse must be afterwards had to those which lye more remote.

Upon the foregoing Principles of Calculation a Judgment may be also formed of the original Expence of making Roads, allowing from two to three Tons of Materials in a Yard forward, and from 6 d. to 1 s. for forming, placing and banking up to the Materials, within the same Space.

will .

will be conveyed to Markets at less Expence, and consequently be afforded cheaper. The Facility of their Communication will contribute to the Enlargement of Trade, and bring them directly from the manufacturing Towns through these smaller Channels upon the great Canal of the World; where the Way is at once open to every foreign market without the necessary Increase of Price, which must attend going through different hands.

Neither is it a Matter of small Moment, that this Measure is agreeable to the Nature and Circumstances of the Inhabitants, as Islanders; whose Connection and Intercourse with other States and Kingdoms, whose Commerce, whose Greatness must arise from a Familiarity with the Element of Water; all which it must therefore have a natural Tendency to promote.

And though it is attended with a seeming consumption of a considerable Tract of Land; yet it will make abundant Compensation for that by lessening the Quantity of Lime-stone used in the Repair of Roads, which will preserve the Sources of Improvement more entire, for the Remainder, by making the Access to Manure more easy in different Parts of the Country;

Country ; by an Increase of Fishery ; and above all by reducing the Number of Horses employed in draught ; which will occasion a proportionably greater Supply of Sustainance from the Produce of the Island to its Inhabitants.

The only Circumstance to be regretted is, that this System met with no earlier Encouragement for the comprehensive Purposes for which it is now adopted ; that the Practicability of carrying it into Execution was not sooner seen or attended to ; which, had it been done, would have saved many thousand Pounds ; would have guarded against innumerable Inconveniencies ; have been productive of great Advantages ; and the present age might have enjoyed in full Maturity, what is now only in its Infancy.

But this is too large a Field to be descanted upon more particularly by the Writer of this Enquiry, whose only Design in introducing the Subject was to offer a few Hints upon it, as connected with that of his Roads, to which he now returns to make some concluding Remarks.

C H A P. VIII.

General Reflections.

THE two great Objects to be kept in view in the Management of Roads, are, to support them in a convenient State for use, and to effect that with as small an Expence, as is possible, of Materials. Neither of these can be effectually obtained without guarding them from unnecessary Injury; and this must be done either by a Limitation of the Weights, the Construction of the Carriages, or the Usage of the Roads; or rather by an Attention in some Degree to every one of these Particulars. No Breadth of Wheels, which is consistent with general Use, can, for the Reasons given in the Course of this Enquiry, make Amends for the Effects of excessive Weights, nor for improper Treatment with even moderate ones. To expect that all Parts of Roads, however circumstanced, can be kept in a State fit for travelling upon, or that the use of mended and unmended Paths may be confounded at all Seasons without an extraordinary Waste of the Materials, is

to expect Things to happen contrary both to Probabilities and Experience.

Nothing could have prevented the Roads in many Parts of *England* from being entirely destroyed by the Increase of Weight, but an Enlargement of the Terms and Powers granted to Commissioners, and particularly an Increase of their Tolls by multiplying Gates; which upon Examination the Author doubts not would be found to have taken Place almost universally, at or since the Commencement of this Scheme, over Tracts of bad Country frequented with heavy Draughts. Whether then it can at best be considered in any other Light than a temporary Expedient, and whether Perseverance in a Measure, which every Bowel of our Country must be ransacked to support, be consistent with the Duty which we owe to Posterity, is a Matter which deserves a very serious Consideration.

A proper Construction of the Carriages is certainly the most easy, and of all others perhaps the most effectual Means of Security to the Roads; but then it should not be such a Construction, as will enable them to carry heavy, but such an one, as will oblige them to carry light Loads. A middling Breadth of Felly to

the Wheels, neither so small as to cut deep, nor yet so great as to prevent a little gradual Impression, which serves as a Guide to keep Carriages in regular Tracks, is the true Method of confining the wearing to a narrow Compass; which with judicious Management will certainly lessen it; and by lessening that, the Roads will be kept clean, and be both more convenient and pleasant for use.

A Limitation of the Number of Horses is desirable for no other Purpose, but as it tends to lessen the Weights; for that Point being obtained, the more easily the Draught is performed, the less Effect will be produced both from the Pressure of the Carriages, and the Treadings of the Horses, and therefore it is the better.

But no Provisions will fully answer the proposed End, without some severe Check upon the Obstinacy and Temerity of Waggoners, many of whom require to be governed with almost as high an Hand as Negroes in the Plantations. A malicious Purpose of destroying the Roads will easily suggest to this Set of Men the Means of accomplishing it, of which there was one memorable Instance in *Warwickshire*,

wickshire at the passing the first Broad-Wheel-Act; about which Period they sustained more Injury from being cut and flashed by the use of different Tracks in a few Months, though the Carriages were drawn by four Horses only, than they had done in as many Years before with the Draught of five; and this merely from Wantonness of Revenge for the Restraints put upon them. Perhaps any future Attempts of the same Kind can be no Way more properly guarded against, than by subjecting these Men, as before hinted, to the Controul of Commissioners and their Agents; who can certainly judge of the Treatment proper for their respective Roads better than it can be ascertained by any general Provision.

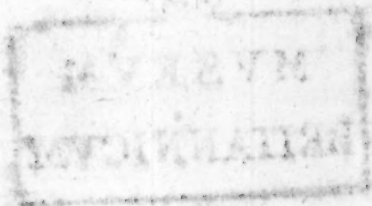
A due Regard to the before mentioned several Circumstances upon Turnpike, and an entire new Regulation of the Statute or Parish Duty for private Roads might probably conduce to bring about the End, which all, who have considered this Subject, have undoubtedly aimed at, how differently soever they may have judged of the Means. In adjusting the Plan of the latter, the Writer apprehends, that any new Model must appear imperfect by which it is
not

provided — That the Office of Surveyor be committed to Persons who have Capacity and Leisure to execute it, who undertake it not by Compulsion but by voluntary Contract; animated by Reward and not by Oaths; — That the Poor be exempted from all Labour except such as they shall be entitled to receive a full Compensation for; but — that for defraying the Expences of Repairs, the first Degree of Taxation shall fall upon Equipages, which are Articles of Luxury, and have a particular Convenience in good Roads; — the next upon all Saddle Horses, and the Horses and Draughts of Carriers travelling for Hire, to which they are also particularly useful; and — That the Remainder shall be raised by an Assessment made without any Regard to ploughlands, which is an unequitable Method of Proportioning it; but according to an equal Pound-rate, which is the most probable Means of extending it to all Persons, according to their Mode and Rank of Living, or the Advantages which they derive from Drift of Cattle or Draught upon them.

These are the several Matters, which seem to be of principal importance in the care and
Preservation

Preservation of Roads. But whether any Thing agreeable to the Method here proposed be approved, or whatever other Scheme shall be thought more eligible, the Writer flatters himself that this Enquiry will appear to have been dictated by a Zeal for the Welfare both of the present and future Ages; it being his only Aim, as it is his fervent Wish, that the Roads, Navigation, and every other Source of Improvement to the Trade, Convenience, Wealth and Prosperity of *Great Britain*, by whatever Means accomplished, may together with its Liberty be immortal.

T H E E N D.



(34)

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